

CLAIMS

- 1 1. A semiconductor device comprising:
2
3 a dielectric layer formed between a conductive layer and upon a silicon
4 substrate, the dielectric layer comprising a layer of silicon oxide,
5 $\text{SiO}_{x \leq 2}$, having a dielectric constant greater than about 3.9 and about \leq
6 12.
- 1 2. The semiconductor device of Claim 1, wherein the layer of silicon
2 oxide has a thickness of about $\leq 5\text{\AA}$.
- 1 3. The semiconductor device of Claim 1, wherein the dielectric layer
2 further comprises at least a second layer of silicon oxide, $\text{SiO}_{x \leq 2}$, having a
3 dielectric constant of about ≤ 12 .
- 1 4. The semiconductor device of Claim 3, wherein the second layer of
2 silicon oxide has a thickness of about $\leq 5\text{\AA}$.
- 1 5. A transistor comprising:
2 an electrode;

3 a silicon substrate; and
4 a gate dielectric layer formed between the electrode and the silicon
5 substrate, the gate dielectric layer comprising at least one layer of
6 silicon oxide, $\text{SiO}_{x \leq 2}$, having a thickness of about $\leq 5 \text{ \AA}$ and a dielectric
7 constant greater than about 3.9 and about ≤ 12 .

1 6. The transistor of Claim 5, wherein the gate dielectric layer comprises
2 at least a second layer of silicon oxide, $\text{SiO}_{x \leq 2}$, having a thickness of about \leq
3 5 \AA and a dielectric constant of about ≤ 12 .

1 7. A method of fabricating a gate dielectric layer, the method comprising
2 the step:
3
4 forming a first layer of silicon oxide, $\text{SiO}_{x \leq 2}$, upon a silicon substrate
5 having a thickness of about $\leq 5 \text{ \AA}$ and a dielectric constant greater than
6 about 3.9 and about ≤ 12 .

1 8. The method of Claim 7, wherein the step of forming a first layer of
2 silicon oxide comprises the steps of:
3
4 forming a monolayer of oxygen upon the silicon substrate by at least
5 one of atomic layer chemical vapor deposition, metal organic chemical
6 vapor deposition and low pressure chemical vapor deposition;

7

8 forming a monolayer of silicon upon the monolayer of oxygen by at
9 least one of atomic layer chemical vapor deposition, metal organic
10 chemical vapor deposition and low pressure chemical vapor deposition;
11 and

12

13 forming a second monolayer of oxygen upon the monolayer of silicon
14 by at least one of atomic layer chemical vapor deposition, metal
15 organic chemical vapor deposition and low pressure chemical vapor
16 deposition.

1 9. The method of Claim 8, wherein at least one of the steps of forming a
2 monolayer of oxygen and forming a second monolayer of oxygen are
3 performed at a temperature of about 1000°C.

1 10. The method of Claim 8, wherein at least one of the steps of forming a
2 monolayer of oxygen and forming a second monolayer of oxygen comprise
3 the step of introducing a dose of about 10^{15} oxygen atoms/cm².

1 11. The method of Claim 8, wherein the step of forming a monolayer of
2 silicon comprises the step of introducing a dose of about 10^{15} silicon
3 atoms/cm².

1 12. The method of Claim 7, wherein the step of forming a first layer of
2 silicon oxide comprises the steps of:

3

4 growing the layer of silicon oxide; and

5

6 etching the silicon oxide layer to a thickness of about $\leq 5\text{\AA}$.

1 13. The method of Claim 8, further comprising the step of:

2

3 forming a second layer of silicon oxide, $\text{SiO}_{x \leq 2}$, upon the first layer of
4 silicon oxide, the second layer of silicon oxide having a thickness of
5 about $\leq 5\text{\AA}$ and a dielectric constant of about ≤ 12 .

1 14. The method of Claim 13, wherein the step of forming a second layer of
2 silicon oxide comprises the steps of:

3

4 forming a third monolayer of oxygen upon the first layer of silicon
5 oxide by at least one of atomic layer chemical vapor deposition, metal
6 organic chemical vapor deposition and low pressure chemical vapor
7 deposition;

8

9 forming a second monolayer of silicon upon the third monolayer of
10 oxygen by at least one of atomic layer chemical vapor deposition, metal

11 organic chemical vapor deposition and low pressure chemical vapor
12 deposition; and

13

14 forming a fourth monolayer of oxygen upon the second monolayer of
15 silicon by at least one of atomic layer chemical vapor deposition, metal
16 organic chemical vapor deposition and low pressure chemical vapor
17 deposition.

1 15. The method of Claim 14, wherein at least one of the steps of forming a
2 third monolayer of oxygen, forming a second monolayer of silicon, and
3 forming a fourth monolayer of oxygen are performed at a temperature of at
4 least about 800°C.

1 16. The method of Claim 14, wherein at least one of the steps of forming a
2 third monolayer of oxygen and forming a fourth monolayer of oxygen
3 comprise the step of introducing a dose of about 10^{15} oxygen atoms/cm².

1 17. The method of Claim 14, wherein the step of forming a second
2 monolayer of silicon comprises the step of introducing a dose of about 10^{15}
3 silicon atoms/cm².